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# Nuclear Nonproliferation

## And Similar Things

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# Outline

- About myself
- Nonproliferation
- Similar things
- Question and answer

# About myself

- June 2017 – PhD in Nuclear Engineering from Missouri University of Science and Technology
- July 2017-June 2018 – National Nuclear Security Administration Fellow at the Department of Energy headquarters in Washington, DC
  - Developed strategic policy recommendations for the Office of Advanced Simulation and Computing
- July 2018 – Postdoc in computational physics at Los Alamos National Laboratory
  - Develop new physics capabilities for the Multiphysics code FLAG

# Question

- What is nuclear nonproliferation?
- What is nuclear counterproliferation?
- What is nuclear disarmament?



# Definitions

- Nonproliferation – Actions taken to prevent the *spread* of nuclear weapons
- Counterproliferation – Actions taken to prevent the *use* of nuclear weapons
- Disarmament – Actions taken to reduce the lethality of nuclear weapons





# Major Treaties

- Limited Nuclear Test Ban Treaty (1963)
  - Bans testing nuclear weapons above ground, in outer space, and under water
- Nuclear Nonproliferation Treaty (1968)
  - Splits the world into Weapon States and Non-weapon States
  - Weapons States will not share nuclear weapon technology
  - Non-weapon States will not pursue nuclear weapon technology
- Intermediate Range Nuclear Forces Treaty (1987)
  - Banned all intermediate range nuclear missiles
- Unilateral Moratorium (1992)
  - Presidential order banning all nuclear testing in the United States
- Comprehensive Test Ban Treaty (1996)
  - Bans all nuclear explosions
  - Signed but never ratified by the United States

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# Question

- How do we know that other Weapon States are compliant with the treaties they signed?
- How do we know that Non-weapon States are not pursuing a weapons program?

# Treaty Verification

- Treaty verification is the process by which treaty partners permit one another or a third party to verify that they are compliant with all treaties
- Consider an imaginary treaty limiting the United States and Russia that limits the United States to actively deploy no more than 200 (imaginary) W-101 weapons. We currently have 253 of them.
  - 200 of these weapons are actively deployed on submarines
  - How does Russia verify that we aren't cheating and deploying the other 53?
  - We point to a storage facility with 53 boxes and claim that these are our undeployed weapons.
  - They have to know that the 53 boxes each contain a W-101 weapon without actually knowing what a W-101 weapon looks like or how it works.
  - We provide a signature of the W-101 weapon that can be measured. They verify the signature by measuring a real W-101
  - They check the 53 boxes that we claim contain the 53 stored W-101s. The signatures should match on each one.

# Treaty Verification

- Two of these crates contain a goat. The other contains a nuclear weapon.
- The boxes are soundproof, you can't touch them, and I won't open them for you.
- Where is the nuke?

1

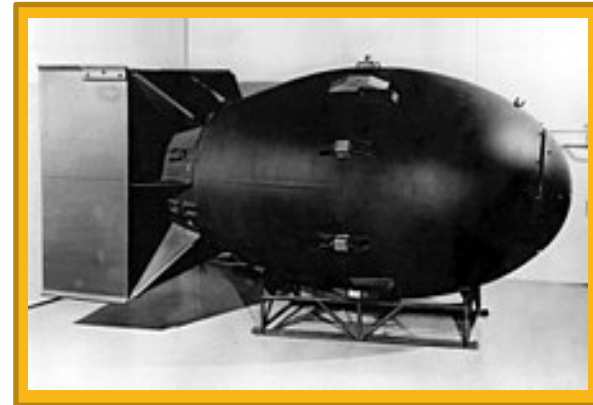
2

3



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Images courtesy of shutterstock.com



# Treaty Verification

- Fast forward ten years
- You haven't been allowed on the premises since you verified the weapon was in box 3.
- How do you know it's still there?
- How do you know it has **remained there untouched** for the last ten years?

1

2

3

# Treaty Verification

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- You haven't been allowed on the premises since you verified the weapon was in box 3.
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# Question

- Why does the United States of America continue to maintain a nuclear arsenal?

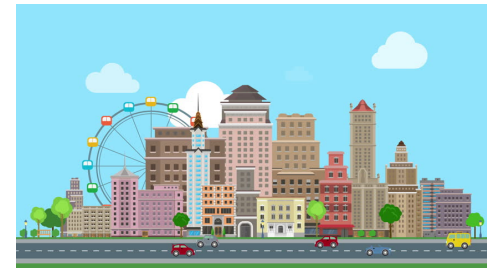
# America's Nuclear Stockpile

- Treaty verification and compliance is **hard**
- Nuclear weapons are a single facet of the military landscape
- The US government believes that maintaining a nuclear arsenal helps achieve global stability

Tactical Warfighting



Strategic Warfighting



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# America's Nuclear Stockpile

- Modern nuclear weapons are *strategic*
- Nuclear weapons deter a nuclear strike on the United States by enabling a reciprocated response
  - Without nuclear weapons, we cannot deter a decapitating strike.
- The impact of the use of a nuclear weapon is so grave, it serves no military purpose except to deter such threats
  - Conventional warfare cannot escalate to a nuclear exchange



Images courtesy of aviationcv.com



# America's Nuclear Stockpile

- Could tactical use of a small weapon lead to *escalation*?



Images courtesy of aviationcv.com



# Question and Answer